

AMENDMENTS TO THE CLAIMS

In the Claims:

1. (Currently amended) A phase changeable memory device, comprising:
 - a substrate;
 - a lower electrode disposed on the substrate;
 - a phase changeable pattern disposed on the lower electrode; **and**
 - an upper electrode disposed on the phase changeable pattern and having a tip that extends therefrom and is directed toward the lower electrode[.]; **and**
 - a shield layer that is disposed on sidewalls of the phase changeable pattern and the upper electrode.**
2. (Original) The phase changeable memory device of Claim 1, further comprising:
 - an interlayer insulating film disposed on the substrate having an opening therein that exposes at least a portion of the lower electrode; and
 - wherein the phase changeable pattern is formed in the opening and has a depression therein that is directed toward the lower electrode.
3. (Original) The phase changeable memory device of Claim 2, further comprising:
 - spacers disposed between opposing sidewalls of the interlayer insulating film and the phase changeable pattern in the opening.
4. (Original) The phase changeable memory device of Claim 2, further comprising:
 - an etch stop layer disposed between the interlayer insulating film and the lower electrode.
5. (Canceled)

6. (Currently amended) A phase changeable memory device, comprising:
a substrate;
a lower electrode disposed on the substrate;
an interlayer insulating film disposed on the substrate having an opening therein that exposes at least a portion of the lower electrode;
a spacer pattern disposed on sidewalls of the opening;
a phase changeable pattern disposed on the lower electrode in the opening and extending on the interlayer insulating film; and
an upper electrode disposed on the phase changeable pattern and having a tip that extends therefrom and is directed toward the lower electrode[.]; and
a shield layer that is disposed on sidewalls of the phase changeable pattern and the upper electrode.

7. (Original) The phase changeable memory device of Claim 6, wherein the phase changeable pattern has a depression therein that is directed toward the lower electrode.

8. (Canceled)

9. (Original) The phase changeable memory device of Claim 6, further comprising:

an etch stop layer disposed between the interlayer insulating film and the lower electrode.

10. (Original) The phase changeable memory device of Claim 6, further comprising:

a plate electrode that is electrically connected to the upper electrode.

11. (Currently amended) A phase changeable memory device, comprising:
a substrate;
a lower electrode disposed on the substrate;

an interlayer insulating film disposed on the substrate having an opening therein that exposes at least a portion of the lower electrode;

an etch stop layer disposed between the interlayer insulating film and the lower electrode;

a spacer pattern disposed on sidewalls of the opening;

a phase changeable pattern disposed on the lower electrode in the opening; and

an upper electrode disposed on the phase changeable pattern and extending on the interlayer insulating film, the upper electrode having a tip that extends therefrom and is directed toward the lower electrode.

12. (Original) The phase changeable memory device of Claim 11, wherein the phase changeable pattern has a depression therein that is directed toward the lower electrode.

13. (Canceled)

14. (Original) The phase changeable memory device of Claim 11, further comprising:

a plate electrode that is electrically connected to the upper electrode.

15. (Currently amended) A method of forming a phase changeable memory device, comprising:

providing a substrate;

forming a lower electrode disposed on the substrate;

forming a phase changeable pattern on the lower electrode; and

forming an upper electrode on the phase changeable pattern that has a tip that extends therefrom and is directed toward the lower electrode[.]; and

forming a shield layer on sidewalls of the phase changeable pattern and the upper electrode.

16. (Original) The method of Claim 15, further comprising:

forming an interlayer insulating film on the substrate that has an opening therein that exposes at least a portion of the lower electrode; and

wherein forming the phase changeable pattern comprises forming the phase changeable pattern in the opening so as to have a depression therein that is directed toward the lower electrode.

17. (Original) The method of Claim 16, further comprising:

forming spacers between opposing sidewalls of the interlayer insulating film and the phase changeable pattern in the opening.

18. (Original) The method of Claim 16, further comprising:

forming an etch stop layer between the interlayer insulating film and the lower electrode.

19. (Canceled)

20. (Currently amended) A method of forming a phase changeable memory device, comprising:

providing a substrate;

forming a lower electrode on the substrate;

forming an interlayer insulating film on the substrate that has an opening therein that exposes at least a portion of the lower electrode;

forming a spacer pattern on sidewalls of the opening;

forming a phase changeable pattern on the lower electrode in the opening and extending on the interlayer insulating film; and

forming an upper electrode on the phase changeable pattern that has a tip that extends therefrom and is directed toward the lower electrode[.]; and

forming a plate electrode that is electrically connected to the upper electrode.

21. (Original) The method of Claim 20, wherein the phase changeable pattern has a depression therein that is directed toward the lower electrode.

22. (Original) The method of Claim 20, further comprising:
forming a shield layer on sidewalls of the phase changeable pattern and the upper electrode.

23. (Original) The method of Claim 20, further comprising:
forming an etch stop layer between the interlayer insulating film and the lower electrode.

24. (Canceled)

25. (Currently amended) A method of forming a phase changeable memory device, comprising:
providing a substrate;
forming a lower electrode on the substrate;
forming an interlayer insulating film on the substrate that has an opening therein that exposes at least a portion of the lower electrode;
forming a spacer pattern on sidewalls of the opening;
forming a phase changeable pattern on the lower electrode in the opening; **and**
forming an upper electrode on the phase changeable pattern and extending on the interlayer insulating film, the upper electrode having a tip that extends therefrom and is directed toward the lower electrode[. . .]; **and**
forming a plate electrode that is electrically connected to the upper electrode.

26. (Original) The method of Claim 25, wherein the phase changeable pattern has a depression therein that is directed toward the lower electrode.

27. (Canceled)

28. (Original) The method of Claim 25, further comprising:

forming an etch stop layer between the interlayer insulating film and the lower electrode.

29. (Canceled)

30. (Currently amended) A method of forming a phase changeable memory device, comprising:

providing a substrate;

forming a lower electrode on the substrate;

forming an etch stop layer on the substrate and the lower electrode;

forming an interlayer insulating film on the etch stop layer, lower electrode and the substrate;

patterning the interlayer insulating film to form a contact hole that exposes at least a portion of the lower electrode;

forming a spacer pattern on sidewalls of the contact hole;

forming a phase changeable material layer in the contact hole on the lower electrode, the phase changeable material layer having a depression therein that is directed toward the lower electrode;

forming a conductive film on the phase changeable material layer; and

patterning the conductive film and the phase changeable material layer to form an upper electrode and a phase changeable pattern, respectively.

31. (Canceled)

32. (Currently amended) The method of Claim 31 30, wherein patterning the interlayer insulating film comprises:

patterning the interlayer insulating film to expose the etch stop layer on a portion of the lower electrode; and

etching the exposed etch stop layer to expose the lower electrode.

33. (Original) The method of Claim 30, wherein the phase changeable material layer is thicker than half of a minimum width of a lower portion of the contact hole.

34. (Original) The method of Claim 30, wherein the conductive film fills the depression of the phase changeable material layer to form a tip directed toward the lower electrode.

35. (Original) The method of Claim 30, further comprising:
forming an upper interlayer insulating film on the upper electrode;
patterning the upper interlayer insulating film to expose a portion of the upper electrode; and
forming a plate electrode on the upper interlayer insulating film that is connected to the exposed portion of the upper electrode.

36. (Original) The method of Claim 35, further comprising forming a shield layer on the upper electrode and sidewalls of the phase changeable pattern prior to forming the upper interlayer insulating film.

37. (Currently amended) A method of forming a phase changeable memory device, comprising:

providing a substrate;
forming a lower electrode on the substrate;
forming an etch stop layer on the substrate and the lower electrode;
forming an interlayer insulating film on the etch stop layer, lower electrode and the substrate;
patterning the interlayer insulating film to form a contact hole that exposes at least a portion of the lower electrode;
forming a spacer pattern on sidewalls of the contact hole;
forming a phase changeable pattern in the contact hole on the lower electrode, the phase changeable pattern having a depression therein that is directed toward the lower electrode;

forming a conductive film on the phase changeable material layer; and patterning the conductive film to form an upper electrode.

38. (Cancelled)

39. (Currently amended) The method of Claim 38 37, wherein patterning the interlayer insulating film comprises:

pattern the interlayer insulating film to expose the etch stop layer on a portion of the lower electrode; and

etching the exposed etch stop layer to expose the lower electrode.

40. (Original) The method of Claim 37, wherein forming the phase changeable pattern comprises:

forming a phase changeable material layer in the contact hole on the lower electrode, the phase changeable material layer having a depression therein that is directed toward the lower electrode such that a deepest point of the depression is located below an upper surface of the interlayer insulating film; and

chemical mechanical polishing the phase changeable material layer to expose the interlayer insulating film to form the phase changeable pattern.

41. (Original) The method of Claim 37, wherein the conductive film fills the depression of the phase changeable material layer to form a tip directed toward the lower electrode.

42. (Original) The method of Claim 37, further comprising:

forming an upper interlayer insulating film on the upper electrode;

patterning the upper interlayer insulating film to expose a portion of the upper electrode; and

forming a plate electrode on the upper interlayer insulating film that is connected to the exposed portion of the upper electrode.

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43. (Original) The method of Claim 42, further comprising forming a shield layer on the upper electrode and sidewalls of the phase changeable pattern prior to forming the upper interlayer insulating film.